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CONSUMER PRACTICES in the HANDLING and STORING of COMMERCIALLY FROZEN FOODS

Two Cities, Two Seasons

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UNITED STATES DEPARTMENT OF AGRICULTURE

PREFACE

Problems of maintaining the quality of frozen foods from the processor to the table of the consumer have been the subject of considerable research by various agencies of the U.S. Department of Agriculture in recent years.

Comprehensive studies on the time-temperature tolerance of frozen foods have been made by the Western Regional Research Laboratory of the Agricultural Research Service.

The Transportation and Facilities Research Division of the Agricultural Marketing Service has investigated frozen-food handling practices in the transportation system and in distribution channels.

Nutrition and Consumer-Use Research programs of the Agricultural Research Service have included studies on the time-temperature patterns of frozen-food compartments of household refrigerators and performance characteristics of the equipment, on the quality and yield of selected foods in various market forms, and on the effect of household preparation on the quality of frozen fruits and vegetables.

Selected publications on the above investigations are given on pages 15-16.

The research reported in this publication was undertaken to find out how frozen foods are handled and stored in the home in order to ascertain to what extent these practices might affect the quality of the food.

The data in this report are based on surveys made by Alderson Associates, Inc., Philadelphia, Pa., under contract with the Department. Faith Clark, Director of the Consumer and Food Economics Research Division, had general supervision of the planning and direction of the project. Evelyn Grossman contributed statistical advice and made an analysis of the sample, and Constance Ward tabulated and assisted in organizing the data.

Earl C. McCracken and Faith Churchill, of the Clothing and Housing Research Division, participated in planning the phases of the study relating to the collection of information on household frozen-food storage equipment.

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CONTENTS

Page
Summary 1
The surveys: Purpose and scope 2
Household frozen-food storage units 3
Use and purchase of frozen foods during survey week 3
Handling practices 4
  From retail market to home 4
  Storage temperature 6
  Length of storage 9
Evaluation of consumer practices 12
Selected publications on frozen-food research 15
Appendix A. Sample analysis 17
Appendix B. Household refrigerating units: Ownership and age 22
Appendix C. Frozen-food use and purchase as related to use and purchase during survey week 24

TABLES

Text Tables

Page
1. Distribution of households in the sample 2
2. Household refrigerating units used for frozen-food storage 3
3. Household use and purchase of frozen foods in survey week 4
4. Protective packing of frozen-food packages for transport from retail market to home 5
5. Median time interval for transport from retail market freezer to home 5
6. Households storing frozen foods at time of interview and storage units in use 6
7. Median and range in temperature of frozen-food storage units in use at time of interview 6
8. Distribution of households storing frozen foods at time of interview according to storage temperature 9
9. Household storage time for food last used in each of the frozen-food groups in survey week 10
10. Household storage time for frozen food held longest before use in survey week 10
11. Household storage times and temperatures 11

Appendix A

Page
12. Specified characteristics of households in Baltimore and Indianapolis, census and survey 18
13. Characteristics of households by survey status in Baltimore (summer 1959 and winter 1960) and Indianapolis (summer 1960 and winter 1961) 20

Appendix B

14. Ownership and median age of refrigerating units 22
15. Distribution of refrigerating units according to age 23

Appendix C

16. Frozen-food use: Distribution of households by last previous use of specified food as related to use in survey week 24
17. Frozen-food purchase: Distribution of households by last previous purchase of specified food as related to purchase in survey week 26

ILLUSTRATIONS

Page
1. Baltimore, Summer and Winter Surveys: Distribution of refrigerating units according to temperature of frozen-food storage unit 7
2. Indianapolis, Summer and Winter Surveys: Distribution of refrigerating units according to temperature of frozen-food storage unit 8
3. Baltimore, Summer and Winter Surveys: Comparison of household storage times and temperatures with quality boundary derived from time-temperature tolerance studies 13
4. Indianapolis, Summer and Winter Surveys: Comparison of household storage times and temperatures with quality boundary derived from time-temperature tolerance studies 14

CONSUMER PRACTICES in the HANDLING and STORING of COMMERCIALLY FROZEN FOODS, Two Cities, Two Seasons

By Ruth A. Redstrom, Elizabeth Davenport, and Janet Murray, *Consumer and Food Economics Research Division, Agricultural Research Service*

SUMMARY

Surveys to obtain information on consumer practices in the handling and storing of commercially frozen foods were made in Baltimore, Md., in the summer of 1959 and the winter of 1960, and in Indianapolis, Ind., in the summer of 1960 and the winter of 1961. The surveys were limited to the cities themselves; suburban areas were excluded. Of the slightly more than 300 housekeeping households interviewed in each city at each season, approximately 80 percent of those in the summer survey and 90 percent of those in the winter reported ever purchasing and using frozen foods in Baltimore and about 86 percent in the summer and 94 percent in the winter survey in Indianapolis. Few of these households in either city used a separate freezer for frozen-food storage—only about 5 percent in Baltimore and slightly more than 10 percent in Indianapolis. In the majority of households, frozen foods were stored in the ice-cube compartment of a refrigerator. Others stored frozen foods in combination refrigerator-freezers, some of which had a separate exterior door for the ice-cube and frozen-food storage compartment.

Only a negligible percentage of households reported that frozen-food packages were wrapped in protective materials to prevent warming or partial thawing during transit from the retail market to the home. The time of exposure to room or outdoor temperatures between the retail display case and the home storage unit, however, was relatively short: In Baltimore, a median of 30 minutes at both seasons; in Indianapolis, about 21 minutes in the summer survey and 36 minutes in the winter survey.

Slightly more than half of the survey households in each city at each season had some frozen food stored in the home at the time of the interview. The temperature in the storage units in use varied widely for each type of refrigerating unit. Distribution of households according to storage temperature revealed that in only about 14 percent of the households in Baltimore and 23 percent of those in Indianapolis were frozen foods being held at the recommended storage temperature of 0° F. or below. The length of home storage, however, was relatively short. In Baltimore, 74 percent of the households surveyed in the summer and 77 percent of those surveyed in the winter reported storage periods of 1 week or less for the one food used during the survey week which had been held longest before being used; in Indianapolis, about 68 percent of the survey households at both seasons.

A comparison of storage times and temperatures with a quality boundary line derived from frozen-food time-temperature tolerance studies indicates that, in the great majority of cases, frozen foods were held in survey households for periods within the time interval for original quality maintenance at a given temperature. Whether and to what degree the original quality of a frozen food had deteriorated before consumer purchase were unknown in this study.

Survey findings, therefore, do not support the hypothesis that considerable quality deterioration of frozen foods occurs in the home, since frozen foods are not often held for long periods in the home refrigerating unit. However, the large percentage of survey households holding frozen foods at temperatures above the recommended storage temperature and the wide variability in temperature for each type of frozen-food storage unit suggest the need to emphasize in consumer-education programs improved temperature control or early use of products.

THE SURVEYS: PURPOSE AND SCOPE

Extensive controlled studies on the quality of frozen foods have shown the relationships between length and temperature of storage and deteriorative changes in the food. Little information has been available, however, on consumer practices in the handling and storing of commercially frozen foods after purchase.

In order to obtain data for practical use in educational and marketing programs, surveys of approximately 300 households were made in each of 2 cities at 2 seasons of the year. Homemakers in representative samples of families in Baltimore, Md., were interviewed in the summer of 1959 and the winter of 1960, and in Indianapolis, Ind., in the summer of 1960 and the winter of 1961. In each city, the same families who furnished information in the first schedule of interviews were reinterviewed at the second season, insofar as possible, in an attempt to determine the consistency of household practices and to obtain a comparison of practices between the two seasons.

Information on the kind of refrigerating space used for holding frozen foods was recorded for each household interviewed. Temperature readings were taken in the storage unit if frozen foods were being held at the time of the interview.

In both Baltimore and Indianapolis, data on the purchase and use of three groups of frozen foods—fruits, juices, and vegetables—were obtained for the 7-day period before the interview. In Indianapolis, the survey was broadened by the addition of two other types of frozen food in order to obtain information on whether consumer practices varied with the expected keeping quality of the food. The additional foods were baked goods, including cakes, pastries, and yeast and quick breads, and a meat group comprising meat, poultry, and fish or seafood—frozen plain, breaded, or with sauces—and meat dinners. Specific information on the length of the time period between retail outlet and home storage or use and the length of the holding period in the home was recorded for foods in each of the five frozen-food categories.

Survey data which might be considered to have a direct bearing on consumer practices with regard to commercially frozen foods are highlighted in the text. A description of the sample designs and their appraisal and additional data on the households obtained in the surveys are presented in appendixes to the report.

A household was considered a housekeeping household and therefore eligible for survey if at least 1 member of the family had eaten 10 meals at home in the 7 days preceding the interview. Slightly more than 300 of the households contacted in the sample blocks of dwelling units in each of the 2 cities fulfilled this requirement (table 1). Certain data were obtained from all housekeeping households, but complete participation in the survey was possible only for those in which commercially frozen foods were used. The percentage of housekeeping households that reported ever having used frozen foods was higher in the winter surveys than in the summer ones in both cities, and slightly higher in Indianapolis than in Baltimore at both seasons—94 and 90 percent in the winter, and 86 and 80 percent in the summer. About 74 percent of the households interviewed in the summer in Baltimore were reinterviewed in the winter, whereas approximately 65 percent were reinterviewed in Indianapolis.

Information on characteristics of survey households, both those in which commercially frozen foods were used and those in which they were not, is given in appendix A together with a description of the sample design and its appraisal.

TABLE 1.—*Distribution of households in the sample*

City and season	Households in the sample				Households using frozen foods	
	Total	House-keeping [1]	Nonhouse-keeping [1]	Not contacted		
	Number	*Number*	*Number*	*Number*	*Number*	*Percent* [2]
Baltimore:						
Summer	373	303	17	53	242	79. 9
Winter	373	307	13	53	273	88. 9
Indianapolis:						
Summer	397	309	25	63	265	85. 8
Winter	400	310	12	78	290	93. 5

[1] Housekeeping household: One in which at least 1 family member had eaten 10 meals from household food supplies during the 7 days preceding the interview.

[2] Percentage of housekeeping households.

HOUSEHOLD FROZEN-FOOD STORAGE UNITS

A great majority of the survey households held or stored frozen foods in the home after purchase and before use. A few households in each city reported purchasing frozen foods only for immediate consumption; in both cities the number using but never storing frozen foods was slightly larger in the winter than in the summer.

Of the households storing frozen foods, about 5 percent in Baltimore and slightly more than 10 percent in Indianapolis had a separate freezer (table 2). These relatively small percentages no doubt reflect the urban character of the samples. The higher percentage of freezer users in Indianapolis than in Baltimore may have been due in part to the fact that the Indianapolis sample included fewer apartment dwellers and the households had a higher median income. By far the greatest number of households interviewed in both cities—between 60 and 70 percent—stored frozen foods in the ice-cube compartment of a refrigerator. About 24 percent of the households in Indianapolis and about 25 and 33 percent of those interviewed in the two surveys in Baltimore used a combination refrigerator-freezer for frozen-food storage. The majority of the refrigerator-freezers in the Baltimore surveys were the single-exterior-door type, whereas the majority of those in Indianapolis had separate doors for the ice-cube and frozen-food storage compartments. Information on the ownership and age of refrigerating units is given in appendix B.

TABLE 2.—*Household refrigerating units used for frozen-food storage*

City and season	Households using frozen foods	Households storing frozen foods						
		Total		In separate freezer	In refrigerator	In combination refrigerator-freezer		
						Total [1]	1 door	2 door
	Number	*Number*	*Percent* [2]	*Percent* [3]	*Percent* [3]	*Percent* [3]	*Percent* [3]	*Percent* [3]
Baltimore:								
Summer	242	236	97. 5	5. 9	61. 4	32. 6	22. 5	8. 0
Winter	273	262	96. 0	5. 3	69. 8	24. 8	15. 3	9. 5
Indianapolis:								
Summer	265	261	98. 5	12. 6	63. 6	23. 8	10. 3	13. 0
Winter	290	275	94. 8	10. 5	65. 8	23. 6	8. 7	13. 8

[1] Includes combination refrigerator-freezers for which the number of exterior doors was not ascertained as follows: 5 in the summer survey in Baltimore, and 1 in the summer survey and 3 in the winter survey in Indianapolis.

[2] Percentage of housekeeping households in which commercially frozen foods were used.

[3] Percentage of households storing frozen foods.

USE AND PURCHASE OF FROZEN FOODS DURING SURVEY WEEK

For purposes of comparison between seasons and cities, use and purchase data for the 7-day periods preceding the interviews are summarized in table 3 for the five frozen-food groups. There was a relatively close parallel between percentage values for use and for purchase of frozen fruits, juices, and vegetables for each of the cities at each season, with only slightly higher percentages of households *using* these frozen products during the survey week. The percentages of households using frozen meats and meat mixtures and frozen baked goods are almost identical to those purchasing these items. This would seem to indicate that frozen foods were not held for long periods in the survey households.

A marked or consistent seasonal variation in consumption or purchase of frozen fruits is not apparent for either city; from about 9 to 14 percent of the survey households had served or bought these products during the week before the interviews. Juices, however, had been used by a decidedly higher percentage of Indianapolis households in the summer survey than in the winter, 44.5 as compared with 30.7 percent, owing to a greater consumption of frozen lemonade in the summer period. A similar variation was not evi-

Table 3.—*Household use and purchase of frozen foods in survey week*

City and season	Households using frozen foods	Households using and purchasing frozen fruits, juices, and vegetables				Households using and purchasing frozen prepared foods		
		Any	Fruits	Juices	Vegetables	Any	Meat and meat mixtures	Baked goods
	Used in survey week							
Baltimore:	*Number*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Summer	242	72. 7	10. 7	43. 8	61. 6	----------	----------	----------
Winter	273	76. 2	11. 7	42. 9	65. 9	----------	----------	----------
Indianapolis:								
Summer	265	67. 9	14. 0	44. 5	45. 7	35. 5	32. 8	10. 6
Winter	290	59. 7	10. 3	30. 7	46. 2	37. 6	32. 8	11. 7
	Purchased in survey week							
Baltimore:								
Summer	242	65. 7	9. 1	36. 4	52. 1	----------	----------	----------
Winter	273	70. 0	11. 4	37. 7	59. 0	----------	----------	----------
Indianapolis:								
Summer	265	61. 9	12. 1	37. 4	42. 3	35. 1	32. 1	9. 8
Winter	290	53. 1	10. 3	24. 1	41. 0	38. 6	31. 4	12. 4

dent in Baltimore; approximately 43 percent of Baltimore households used frozen juices in the survey weeks at both seasons.

There was no indication of seasonal effect in the percentage figures for consumption or purchase of frozen vegetables in Indianapolis, but a slightly higher percentage of Baltimore households had used and bought them in the winter than in the summer. No seasonal differences are noted in the use or purchase of frozen meats and prepared foods. About one-third of the households reported using frozen meats and meat mixtures; one-tenth, baked goods.

In the three food groups where comparable data are available, the only remarkable difference between the two cities occurred in the consumption and purchase of frozen vegetables, with Baltimore households reporting a considerably higher percentage of use and purchase than Indianapolis. Almost two-thirds of Baltimore households had prepared and served frozen vegetables during the survey week, whereas less than one-half of those in Indianapolis had used frozen vegetables. A similar disparity in the percentage of households purchasing frozen vegetables can be observed between the two cities.

The most commonly used or purchased frozen fruits and juices in the weeks of the surveys were the same in both cities—strawberries and peaches, and orange juice, lemonade, and grape juice. In Baltimore, the vegetables most frequently used or bought were lima beans, spinach, and green peas; whereas broccoli, green peas, and potatoes were the most popular selections in Indianapolis. Plain and breaded fish or seafood led the list of frozen meats and meat dishes used and purchased, followed in order of popularity by meat or poultry pies and frozen dinners with meat. Frozen fruit, pastries, pancakes, and waffles were the most popular items of the baked goods.

Frozen-food use and purchase data for time periods preceding the survey week, obtained from all survey households, are summarized in appendix C.

HANDLING PRACTICES

From Retail Market to Home

Protective Packing

Grocery packers in retail markets sometimes give special attention to frozen-food packages by placing them in insulated bags, kraft-paper bags, or other wrappings which offer some protection against warming or partial thawing in outdoor temperatures during transfer from store to home. Homemakers were asked whether any protective wrapping had been given the last food purchased, not necessarily during the 7 days preceding the interview, in each of the frozen-food groups. The number of households responding and the percentage reporting special packing are given in table 4 for each food group by city and season.

Only for frozen fruits in the summer surveys did more than 10 percent of the households—11.5 percent in Baltimore and 13.5 percent in

TABLE 4.—*Protective packing of frozen-food packages for transport from retail market to home*

City and season	Fruits		Juices		Vegetables		Meat, poultry, fish, and mixtures		Baked goods	
	Households reporting	Special packing	Households reporting	Special packing	Households reporting	Special packing	Households reporting	Special packing	Households reporting	Special packing
Baltimore:	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Summer	131	11. 5	197	6. 6	230	4. 3	--------	--------	--------	--------
Winter	160	6. 9	215	6. 5	258	3. 5	--------	--------	--------	--------
Indianapolis:										
Summer	192	13. 5	214	7. 0	240	7. 1	219	6. 8	137	2. 9
Winter	202	7. 4	230	3. 5	267	3. 7	247	4. 5	152	2. 0

Indianapolis—report protective wrapping in the retail market. Only a little more than half as many reported special packing for frozen fruits in the winter surveys. In Baltimore, there was no comparable seasonal variation for special packing of purchased containers of frozen juices and vegetables. In Indianapolis, however, a definite seasonal trend was observed for foods in all groups with the exception of baked goods. The percentages were low at each season—about 7 percent in the summer surveys and from about 3.5 to 4.5 percent in the winter. Only about 2 to 3 percent of the households purchasing baked goods reported special packing at either season. Irregularity of size and shape of some baked goods packages, particularly those for fruit pies that proved to be the most popular item used and purchased, would make special packing in standard-sized insulated bags difficult and may account for the lower percentage for this food group.

Length of Time

The length of the interval between the time a consumer removes a frozen-food package from the market freezer case and the time it is placed in the home refrigerating unit, as well as the temperature during this period of exposure, may be an important factor in quality deterioration. Homemakers furnished information on the length of exposure during transport for the last food purchased during the survey week or before the survey week in each of the five food groups (table 5). The median

TABLE 5.—*Median time interval for transport from retail market freezer to home*

City and season	Fruits		Juices		Vegetables		Meat, poultry, fish, and mixtures		Baked goods	
	Households reporting	Median time	Households reporting	Median time	Households reporting	Median time	Households reporting	Median time	Households reporting	Median time
	Market freezer to home storage unit									
Baltimore:	*Number*	*Minutes*	*Number*	*Minutes*	*Number*	*Minutes*	*Number*	*Minutes*	*Number*	*Minutes*
Summer	111	30	175	30	199	30	--------	--------	--------	--------
Winter	130	30	185	30	218	30	--------	--------	--------	--------
Indianapolis:										
Summer	158	23	204	21	221	22	183	21	110	20
Winter	169	35	212	37	234	36	195	36	117	37
	Market freezer until use without storing									
Baltimore:										
Summer	15	76	21	26	25	29	--------	--------	--------	--------
Winter	18	57	30	54	28	55	--------	--------	--------	--------
Indianapolis:										
Summer	43	55	21	20	26	23	45	29	29	25
Winter	38	130	29	28	41	52	57	57	35	55

TABLE 6.—*Households storing frozen foods at time of interview and storage units in use*

City and season	Households using frozen foods	Households storing frozen foods at time of interview		Frozen-food storage units in use			
				Refrigerators	Refrigerator-freezers		Separate freezers
					1 door	2 door	
	Number	*Number*	*Percent*	*Number*	*Number*	*Number*	*Number*
Baltimore:							
Summer	242	134	55. 3	71	35	15	13
Winter	273	145	53. 1	84	27	21	13
Indianapolis:							
Summer	265	144	54. 3	69	21	27	27
Winter	290	153	52. 8	81	16	31	25

time intervals for the number of households reporting time between market freezer and home storage are comparable for the two cities. The median time for each of the three food groups in Baltimore at both seasons was 30 minutes; the median varied for the five groups in Indianapolis, ranging from 20 to 23 minutes in the summer survey and from 35 to 37 minutes in the winter one.

The last frozen food purchased was used on the day of purchase without storing in some households in each city. The median time intervals for these relatively few households show no consistent trends with season or among the food groups. Allowance for thawing before use is no doubt included for some foods.

Storage Temperature

Slightly more than one-half of the survey households in the two cities had some frozen food stored in their home refrigerating unit at the time of the interview (table 6). Approximately half of these households had the food stored in the ice-cube compartment of a refrigerator.

Median temperature and range in temperature for the various storage units in use are given in table 7. The median temperatures, in general, show differences among the refrigerating units, although there was a wide range in temperature for each type of unit. Separate freezers had the lowest median temperature of 0° F. or slightly below with the exception of those in use in the summer survey in Baltimore. In both cities, other units ranked in the same order according to successively higher median temperatures: Refrigerator-freezers with two exterior doors, with one exterior door, and ice-cube compartment of refrigerator.

The distribution of household refrigerating units according to the temperature of the frozen-food storage unit illustrates the variability of temperature for each type of refrigerating unit (figs. 1 and 2).

In Baltimore, the range in temperature was about as wide for one-door refrigerator-freezers as for refrigerator ice-cube compartments, extending from below 0° to 30° F. and above. Temperatures in separate freezers and two-door refrigerator-

TABLE 7.—*Median and range in temperature of frozen-food storage units in use at time of interview*

City and season	Temperature of storage unit							
	Refrigerators		Combination refrigerator-freezers				Separate freezers	
			1 exterior door		2 exterior doors			
	Median	Range	Median	Range	Median	Range	Median	Range
Baltimore:	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*	*° F.*
Summer	20	45 to 0	10	30 to −4	4	20 to −2	10	32 to −10
Winter	19	40 to 0	15	34 to 0	4	15 to −15	0	19 to −10
Indianapolis:								
Summer	12	40 to −20	8	60 to −10	5	45 to −9	0	20 to −20
Winter	15	32 to −3	5	12 to −6	5	18 to −10	−3	20 to −20

Baltimore

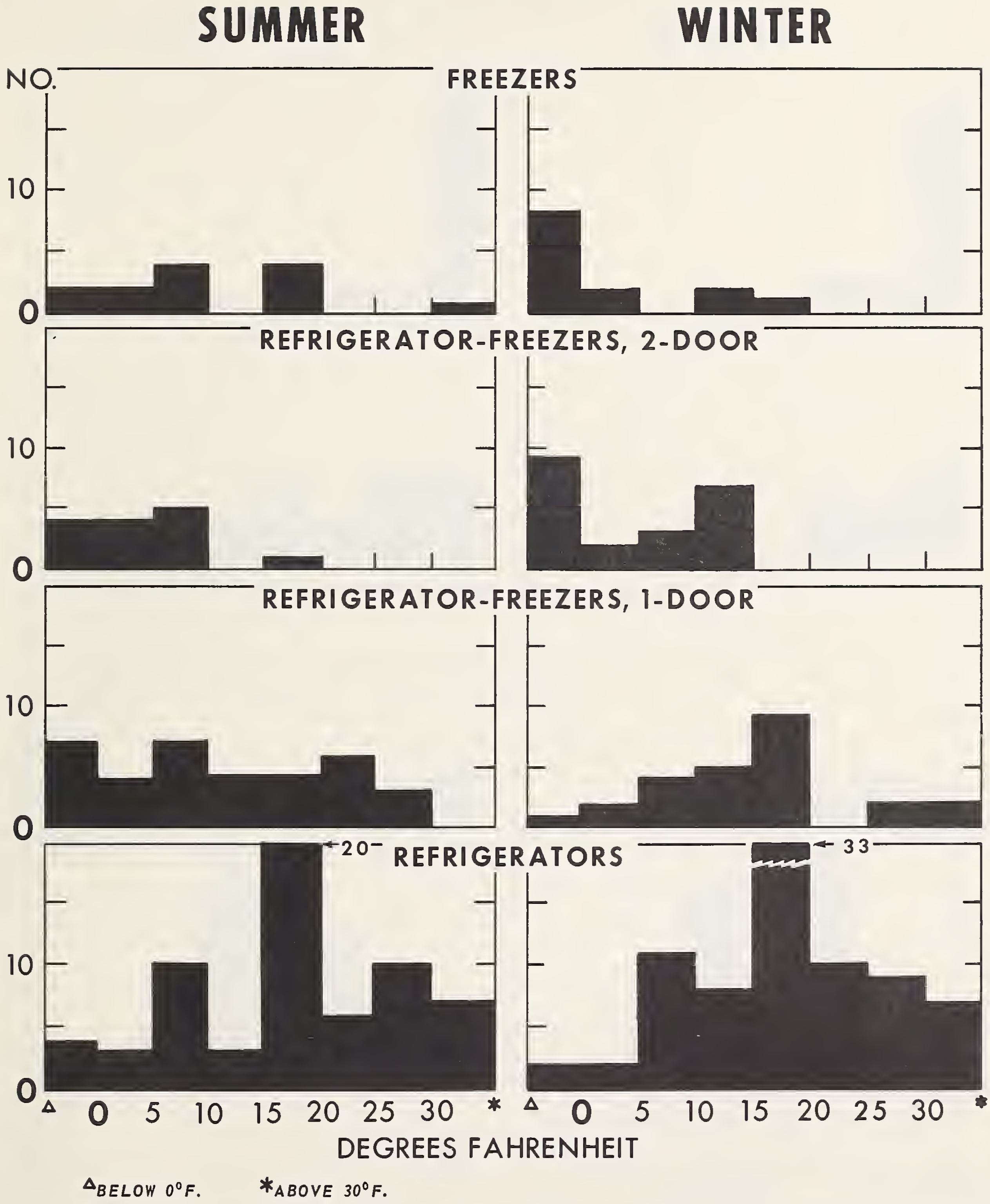

FIGURE 1.—BALTIMORE, SUMMER and WINTER SURVEYS: Distribution of refrigerating units according to temperature of frozen-food storage unit.

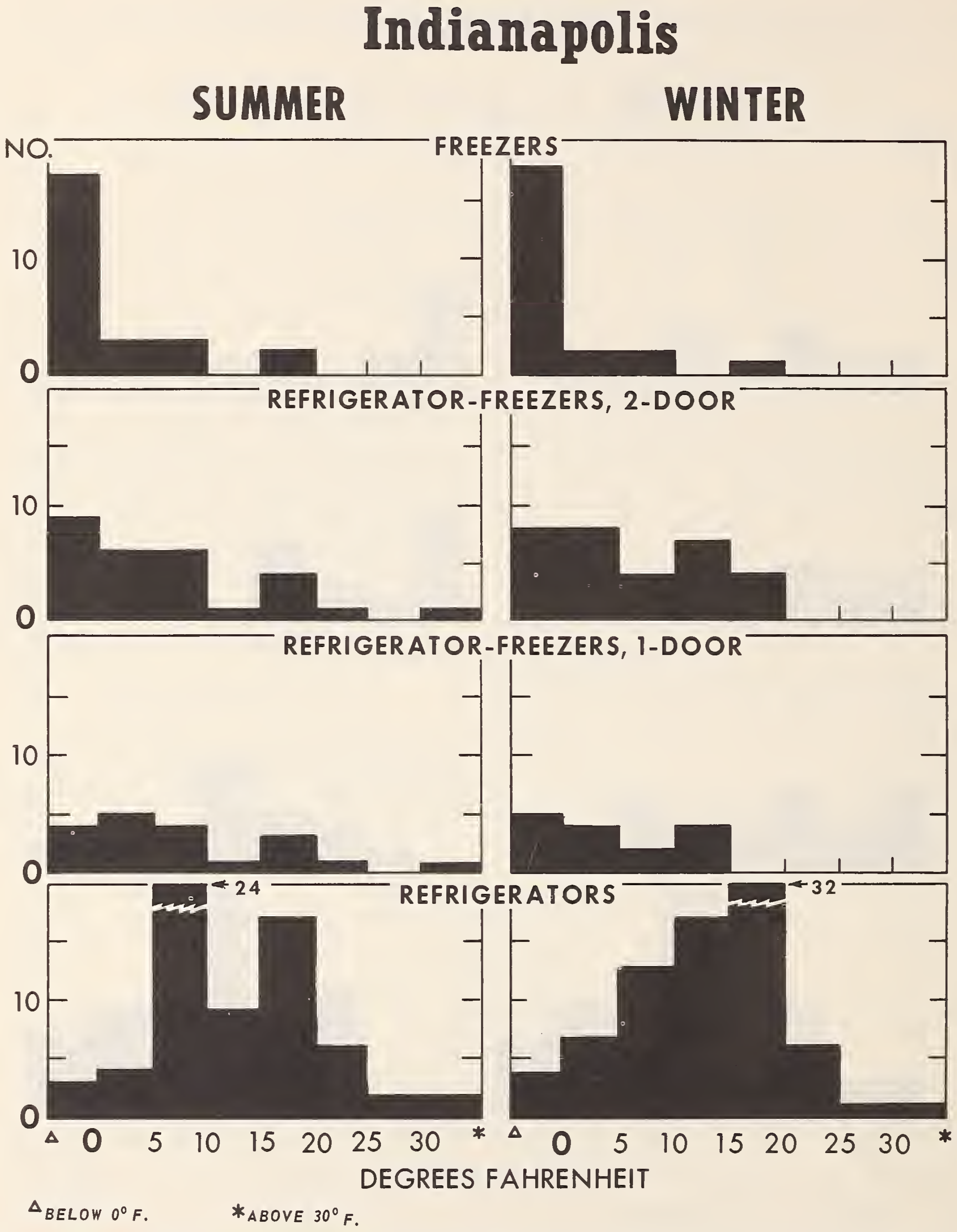

FIGURE 2.—INDIANAPOLIS, SUMMER and WINTER SURVEYS: Distribution of refrigerating units according to temperature of frozen-food storage unit.

Table 8.—*Distribution of households storing frozen foods at time of interview according to storage temperature*

City and season	Households reporting	Households storing frozen foods at temperatures up to and including—							
		0° F.	5° F.	10° F.	15° F.	20° F.	25° F.	30° F.	All temperatures
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Baltimore:									
Summer	125	13.6	24.0	44.8	50.4	73.6	83.2	93.6	100
Winter	141	14.2	19.9	32.7	48.3	78.8	85.9	93.7	100
Indianapolis:									
Summer	139	23.7	36.6	63.2	71.1	89.8	95.6	97.0	100
Winter	150	23.3	37.3	51.3	70.0	94.7	98.7	99.0	100

freezers had a narrower range, extending from below 0° to 20° with the exception of one separate freezer in the summer survey. As would be expected, a proportionately smaller number of refrigerator ice-cube compartments than of all other types of units registered temperatures in the lower levels of the range. Less than one-third of the total number of ice-cube compartments were 15° or below at either season. About one-half of the one-door refrigerator-freezers in the summer survey and one-fourth of those in the winter survey registered 10° or below. More than half of the two-door refrigerator-freezers in both surveys had a storage temperature of 5° or below. Of the 13 separate freezers in each of the surveys, only 2 registered 0° or below in the summer, but 8 were 0° or below in the winter.

In Indianapolis, the extent of the range in temperature was similar to that in Baltimore for all refrigerating units except the two-door refrigerator-freezers in the summer survey, two of which exceeded the Baltimore upper limit of 20° F. The proportionate number of units at the lower temperature groupings in the Indianapolis surveys, however, was considerably different from those in Baltimore, particularly for refrigerators and one-door refrigerator-freezers. The storage temperature in more than half of the refrigerators was 15° or below, as compared with less than one-third in Baltimore. About two-thirds to almost three-fourths of the total number of one-door refrigerator-freezers had storage temperatures of 10° or below, as compared with one-fourth to one-half of those in Baltimore. Proportionate numbers of two-door refrigerator-freezers were similar in both cities, with slightly more than one-half of the total number registering 5° or below at both seasons. From about two-thirds to three-fourths of the separate freezers in Indianapolis had a storage temperature of 0° or below.

Distribution of households according to temperature of the frozen-food storage unit, regardless of the type of refrigerating unit, shows that frozen foods were being held at the recommended storage temperature of 0° F. or below at the time of the interview in about 14 percent of the households in Baltimore and 23 percent of those in Indianapolis (table 8). Because of the difference between the two cities in proportionate numbers of refrigerating units at the lower levels of the temperature range, a consistently higher percentage of households in Indianapolis approximated the recommended storage temperature. More than one-third of the Indianapolis households but less than one-fourth of those in Baltimore were storing foods at 5° or below. Almost three-fourths of the frozen-food storage units in use in Indianapolis registered a temperature of 15° or below as compared with about one-half of those in Baltimore.

Length of Storage

If any food in each of the frozen-food categories had been used during the 7-day period preceding the interview, homemakers were asked how long the last-used package in each category had been stored in the home. The number of households reporting and the percentage of households holding foods for the time intervals indicated are given in table 9.

In the three frozen-food groups for which comparable data are available from both Baltimore and Indianapolis, a large percentage of households in each city had held the last-used food in each category less than 1 day or from 1 day to 1 week; combined percentages for the two holding-time intervals were similar in the two cities, ranging from about 74 to 83 percent in Baltimore and from about 69 to 84 percent in Indianapolis. In from about 8 to 16 percent of the households in Baltimore and from 5 to 17 percent of those in Indianapolis, storage times of more than 1 week but not more than 2 weeks were reported. Only a few households in either city reported home storage times longer than 2 weeks.

In the Indianapolis surveys, storage periods for meat, poultry, and seafood and for baked goods were similar to those reported for fruits, juices, and vegetables. The kind of food did not appear to be a factor in determining the length of home storage, nor were consistent seasonal variations observed in either city. The great percentage of households reporting relatively short holding periods may be explained by the fact that more

Table 9.—*Household storage time for food last used in each of the frozen-food groups in survey week*

City and season	Households reporting	Households storing last frozen food used for—							
		Less than 1 day	From 1 day to 1 week	From 1 to 2 weeks	From 2 to 3 weeks	From 3 to 4 weeks	From 4 to 5 weeks	From 5 weeks to 6 months	More than 6 months
					Fruits				
Baltimore:	*Number*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Summer	26	7. 7	73. 1	7. 7	0	11. 5	0	0	0
Winter	31	9. 7	64. 5	12. 9	0	6. 5	0	6. 5	0
Indianapolis:									
Summer	37	24. 3	59. 5	5. 4	0	2. 7	2. 7	2. 7	2. 7
Winter	30	10. 0	70. 0	6. 7	6. 7	3. 3	3. 3	0	0
					Juices				
Baltimore:									
Summer	103	9. 7	68. 9	14. 6	4. 9	0	1. 0	0	1. 0
Winter	115	10. 4	73. 0	10. 4	2. 6	2. 6	0	0	. 9
Indianapolis:									
Summer	118	1. 7	72. 0	16. 1	3. 4	1. 7	0	4. 2	. 8
Winter	88	6. 8	62. 5	13. 6	8. 0	5. 7	1. 1	2. 3	0
					Vegetables				
Baltimore:									
Summer	149	13. 4	64. 4	13. 4	2. 0	6. 0	0. 7	0	0
Winter	178	12. 4	69. 1	7. 3	3. 4	3. 9	2. 2	1. 1	. 6
Indianapolis:									
Summer	121	8. 3	68. 6	9. 9	5. 8	5. 0	0	1. 7	. 8
Winter	134	6. 0	63. 4	15. 7	6. 7	3. 7	1. 5	3. 0	0
					Meat, poultry, and seafood				
Indianapolis:									
Summer	87	21. 8	57. 5	13. 8	0	3. 4	1. 1	2. 3	0
Winter	96	17. 7	64. 6	9. 4	2. 1	4. 2	0	2. 1	0
					Baked goods				
Indianapolis:									
Summer	28	35. 7	42. 9	17. 9	0	0	0	0	3. 6
Winter	34	14. 7	76. 5	8. 8	0	0	0	0	0

Table 10.—*Household storage time for frozen food held longest before use in survey week*

City and season	Households reporting	Households storing last frozen food used for—							
		Less than 1 day	From 1 day to 1 week	From 1 to 2 weeks	From 2 to 3 weeks	From 3 to 4 weeks	From 4 to 5 weeks	From 5 weeks to 6 months	More than 6 months
Baltimore:	*Number*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Summer	176	9. 1	64. 8	15. 3	4. 0	5. 1	1. 1	0	0. 6
Winter	206	11. 7	65. 5	11. 7	3. 4	3. 9	1. 5	1. 5	1. 0
Indianapolis:									
Summer	203	7. 4	62. 1	17. 7	3. 0	4. 4	1. 0	3. 4	1. 0
Winter	210	9. 5	58. 1	15. 7	7. 6	5. 2	1. 4	2. 4	0

than half of the housekeeping households stored frozen foods in the ice-cube compartment of a refrigerator where limited space and periodic defrosting would preclude long-term storage.

Many families in both cities had used foods from several frozen-food categories during the survey week. Storage times for the one food held longest before use, from any of the categories for which data were collected, are presented in table 10. The same pattern of short-term home

TABLE 11.—*Household storage times and temperatures*

Storage temperature, ° F	Households reporting	Storage time for last food used						
		1 week or less	From 1 to 2 weeks	From 2 to 3 weeks	From 3 to 4 weeks	From 4 to 5 weeks	From 5 weeks to 6 months	More than 6 months
	Baltimore—Summer							
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
0 and below	13	6	5	1	1	0	0	0
1 to 5	11	5	3	0	2	0	0	1
6 to 10	26	16	6	1	2	1	0	0
11 to 15	6	4	2	0	0	0	0	0
16 to 20	24	18	2	0	3	1	0	0
21 to 25	10	9	0	1	0	0	0	0
26 to 30	9	8	0	1	0	0	0	0
31 and above	5	4	0	1	0	0	0	0
Total	104	70	18	5	8	2	0	1
	Baltimore—Winter							
0 and below	17	9	3	1	1	1	1	1
1 to 5	8	4	3	0	0	0	1	0
6 to 10	17	13	2	1	1	0	0	0
11 to 15	19	12	3	1	2	1	0	0
16 to 20	37	30	4	1	2	0	0	0
21 to 25	8	6	1	1	0	0	0	0
26 to 30	8	6	1	1	0	0	0	0
31 and above	8	5	2	0	0	0	0	1
Total	122	85	19	6	6	2	2	2
	Indianapolis—Summer							
0 and below	28	10	9	0	3	1	4	1
1 to 5	14	6	4	1	2	0	1	0
6 to 10	28	16	10	1	0	0	1	0
11 to 15	9	7	0	1	1	0	0	0
16 to 20	20	15	3	0	1	0	1	0
21 to 25	7	4	2	0	1	0	0	0
26 to 30	2	2	0	0	0	0	0	0
31 and above	2	1	0	1	0	0	0	0
Total	110	61	28	4	8	1	7	1
	Indianapolis—Winter							
0 and below	29	10	5	6	4	3	1	0
1 to 5	18	11	3	2	1	0	1	0
6 to 10	20	10	5	2	1	0	2	0
11 to 15	23	15	2	2	3	0	1	0
16 to 20	31	19	10	1	1	0	0	0
21 to 25	6	3	3	0	0	0	0	0
26 to 30	1	1	0	0	0	0	0	0
31 and above	1	1	0	0	0	0	0	0
Total	129	70	28	13	10	3	5	0

storage, evident for the last-used package in each frozen-food category, is shown in the maximum storage periods reported for the last-used package of a food from any of the three or five categories. Homemakers in about 7 to 12 percent of the households reported a maximum storage period of less than 1 day and in about 58 to 66 percent of the households, from 1 day to 1 week. The combined percentages for these two holding-time intervals ranged from 68 to 77 percent of the households in both cities. In about 12 to 18 percent of the households the longest held food had been in home storage from 1 to 2 weeks. Only a small number of households, 5 percent or less of those reporting, stored frozen foods for periods longer than 4 weeks.

Of the households whose storage units registered 0° F. or below, about half of those in Baltimore and one-third of those in Indianapolis reported a maximum storage time of 1 week or less for the last-used food (table 11). An increasingly larger proportion of the households reporting had held food for this short period in units at higher temperatures. A storage period of from 1 to 2 weeks was reported by the next largest number of households at most temperature groupings. Relatively few households in either city, and most often those whose storage units were in the lower levels of the temperature range, had held foods longer than 2 weeks. Of the households whose storage units registered above 20°, only three in each of the surveys in Baltimore and two in the summer survey in Indianapolis reported storage longer than a 2-week period for the last-used food.

Because of their interrelations, neither length of storage nor storage temperature can be considered separately as a determining factor in estimating the degree of quality maintenance of frozen foods. The storage temperature of household refrigerating units was obtained if frozen foods were being held at the time of the interview. In most of these homes, some frozen foods had been used during the survey week and information on maximum storage of the last food used from any of the three or five frozen-food groups is available. It is recognized that, during storage of the particular food for which storage time is available, the temperature may not have been the same as that on the day of the interview and that it may not have remained constant. These data on time and temperature are presented together, however, in order to obtain an indication of the effectiveness of household practices.

EVALUATION OF CONSUMER PRACTICES

In evaluating the effect of household practices, it must be remembered that in the home are the last of a succession of handling experiences that affect the quality of frozen foods. Conditions during processing, warehouse storage, and display in the retail market and in the transportation system, as well as those in the home, will determine the ultimate quality of a frozen food. The history of commercially frozen foods before purchase by the consumer is, of course, unknown. If a frozen food had been subjected to mishandling or to repeated exposure to temperatures above 0° F. in the distribution system, its quality might have been damaged to a slight, moderate, or even severe degree before it reached the consumer. An ideal home-storage temperature of 0° could not then restore the original quality of the food, but a higher temperature would have its effect in cumulative deterioration.

The integrated effect of time and temperature has been studied extensively at the Western Regional Research Laboratory of the Agricultural Research Service under controlled conditions comparable to those which might actually be encountered in the commercial distribution system for frozen foods. As a result of these studies, various time-temperature combinations which cause an equivalent degree of change in original quality were determined for selected foods. The approximate average time intervals producing an essentially equivalent, measurable change in color, flavor, or texture discernible to a trained, selected taste panel are as follows for most frozen foods studied:[1]

Time:	*Temperature* ° *F.*
1 year	0
5 months	5
2 months	10
1 month	15
2 weeks	20
1 week	25
3 days	30

The time interval at a given temperature has been referred to as the "high quality life" of a frozen food stored at that temperature. Some of the quality changes brought about by each of these time-temperature combinations might not affect consumer acceptance of a frozen product, however, and in fact might be undetected by other than trained panel members. A quality boundary line has been derived from these laboratory-determined time-temperature combinations to serve as a necessarily arbitrary criterion for the evaluation of the storage practices of the consumers interviewed in Baltimore and Indianapolis.

Survey data on household storage times and temperatures have been plotted in figures 3 and 4 for comparison with the quality boundary line in order to obtain an indication of the extent to

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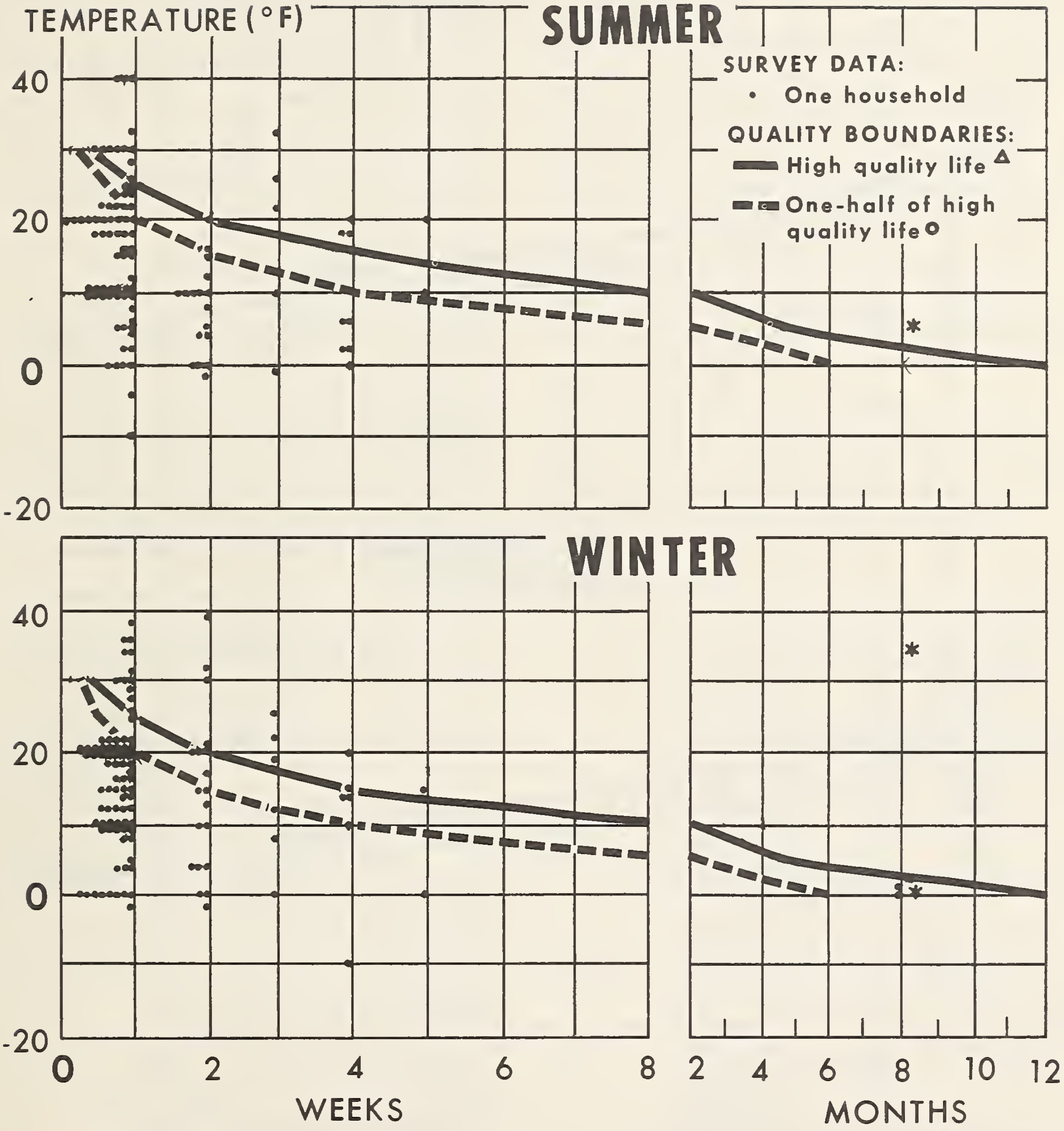
[1] Guadagni, D. G. Integrated Time-Temperature Experience as it Relates to Frozen Food Quality. Amer. Soc. Heating, Refrigerating, and Air-Conditioning Engin. Jour. 3(4): 66–69.

Baltimore



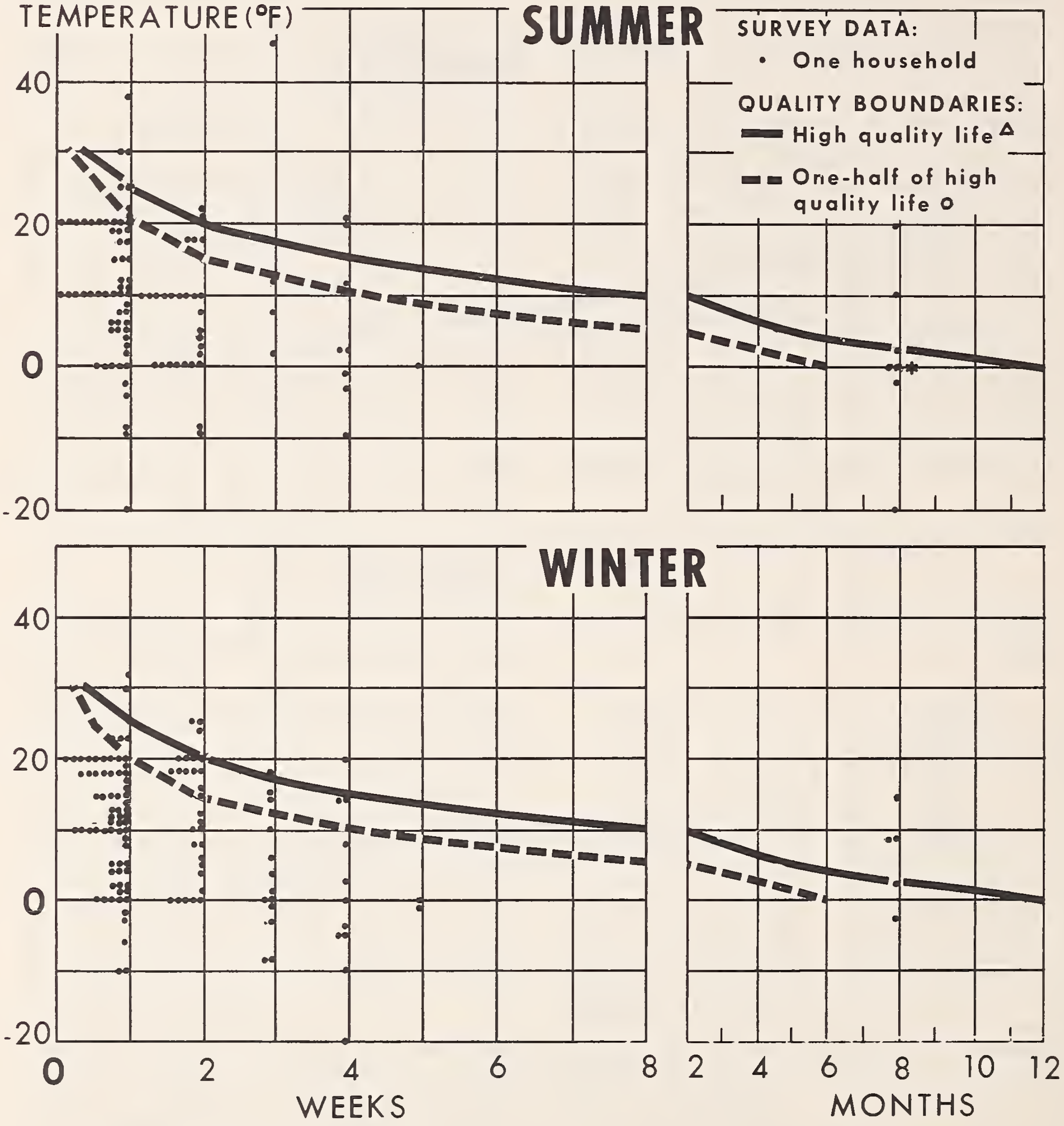
*STORED LONGER THAN 6 MONTHS.

△ASSUMING FROZEN FOODS PURCHASED BY SURVEY HOUSEHOLDS HAD ORIGINAL HIGH QUALITY.

○ASSUMING ONE HALF OF HIGH QUALITY LIFE OF FROZEN FOODS PURCHASED BY SURVEY HOUSEHOLDS HAD BEEN EXPENDED.

Figure 3.—Baltimore, Summer and Winter Surveys: Comparison of household storage times and temperatures with quality boundary derived from time-temperature tolerance studies.

Indianapolis



*STORED LONGER THAN 6 MONTHS.

△ASSUMING FROZEN FOODS PURCHASED BY SURVEY HOUSEHOLDS HAD ORIGINAL HIGH QUALITY.

○ASSUMING ONE HALF OF HIGH QUALITY LIFE OF FROZEN FOODS PURCHASED BY SURVEY HOUSEHOLDS HAD BEEN EXPENDED.

FIGURE 4.—INDIANAPOLIS, SUMMER and WINTER SURVEYS: Comparison of household storage times and temperatures with quality boundary derived from time-temperature tolerance studies.

which the storage conditions exceeded the limits bounding the high quality life of frozen foods. Any comparison of survey data with that from laboratory studies must, of course, be qualified. Each temperature plotted is the actual reading of a storage unit in use at the time of the interview; the storage time is for the longest held package of a food used by the household during the survey week from any of the frozen-food groups for which data were collected. Data on the length of storage is less exact than that for temperature because of the impracticability of obtaining precise recollection of the number of days or months. Storage times, therefore, are plotted from the maximum line of demarcation between storage intervals.

The laboratory time-temperature relationships were determined on the basis of change in *original* quality. For purposes of this comparison, therefore, it is assumed that the frozen foods stored in survey households had their original high quality at the time of purchase. It also is assumed that the temperature in the storage unit remained constant during the period of storage, as was true in the laboratory studies, and that it was the same as that recorded on the day of the interview. Under these assumed conditions, it is apparent that a large percentage of households in both cities at each season stored foods for periods within the time interval for original quality maintenance at a given temperature. In Baltimore, about 81 percent of the 104 households in the summer survey and 82 percent of the 122 households in the winter survey did not exceed the time interval; in Indianapolis, about 91 percent of the 110 households in the summer survey and 92 percent of the 129 households in the winter survey. The difference in percentages of households between the two cities was due to the temperature of the refrigerating unit (table 8) rather than the length of time the food was held (table 10).

To assume that frozen foods encounter no adverse conditions before purchase, and that all of their high quality life is at the disposal of the consumer, is, of course, unrealistic. A quality boundary line defining the limits of one-half of the high quality life, therefore, also is included in the figures. If one-half of it had been expended before consumer purchase, a lower percentage but still a decided majority of survey households had used their purchased frozen foods before that high quality life expired.

From these data, it would appear that, in the great majority of cases, household practices alone would not be a determining factor in serious quality deterioration of frozen foods.

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APPENDIX A

Sample Analysis[2]

The surveys were made in two cities in two seasons each: Baltimore in the summer of 1959 with revisits in the winter of 1960[3] and Indianapolis in the summer of 1960 with revisits in the winter of 1961.[4]

The households that were asked to provide the information were chosen to represent housekeeping households—those including at least one family member who ate 10 meals or more from the household food supply during the 7 days before the interview. Approximately 300 participated each season in each city. More than 200 in each location participated both seasons. The others were housekeeping but not willing or able to provide data more than once.

Sample Selection

The households were selected in several stages. In Indianapolis, 59 census tracts were selected systematically; from each tract an enumeration district was chosen (two districts were chosen from one large tract) and from each district one block was selected. In Baltimore, 60 blocks were systematically selected in the first stage. "Blocks" are defined here as: (1) ordinary blocks; (2) "block groups"—a combination of blocks including one or more with low dwelling unit density; or (3) "chunks" of blocks in which the dwelling unit density was high.

The selections up to this stage were made with probability proportionate to dwelling unit counts. In Baltimore these counts were based on 1950 census reports brought up to date with local estimates of construction, conversion, and demolition. In Indianapolis, counts from a special census in 1956 were used after adjustment to exclude dwellings outside the city boundaries.

Households were prelisted in each sample block and a number were selected from each so as to keep the probability of household selection uniform.

History of Visits

The same dwellings were visited both seasons regardless of status during the summer.

About three-fourths of the housing units visited yielded schedules each season as follows:

	Baltimore	Indianapolis
Housing units visited...number	391	423
Schedules in summer...do	303	309
percent	77	73
Schedules in winter...number	307	310
percent	79	73

Some of the housing units were vacant: 4 percent in Baltimore for each season but not the same units both times, and about 6 percent in Indianapolis with 2 percent vacant both seasons. In the occupied housing units, 4½ percent (Baltimore) and 6½ percent (Indianapolis) of the households were not housekeeping in the summer, and 3½ percent and 3 percent (Baltimore and Indianapolis, respectively) were not housekeeping in the winter. These nonhousekeeping rates may be understated, because in Baltimore in each season 15 percent of the households were not contacted (these include some housekeeping households not willing or able to participate), and in Indianapolis 12 percent of the households were not contacted in the summer and 9 percent were not contacted in the winter. (These do not include the 4 percent and 10 percent, summer and winter, respectively, who kept house but were unwilling or unable to participate.)

When dwelling units were resurveyed after passage of several months, some households had moved away, others had moved in, and some of those remaining had changed status. The scheduled households that used frozen foods in the summer yielded the following status distribution in the winter:

	Baltimore	Indianapolis
	Number	*Number*
Used frozen foods in summer	242	265
Winter status:		
Moved:		
Housing unit vacant	5	9
Different household	13	44
Not contacted [1]	28	11
Not housekeeping	3	2
Housekeeping—not participating	(1)	24
Scheduled:		
Using frozen food	179	172
Not using frozen food	14	3

[1] Housekeeping not participating included with those not contacted in Baltimore.

Those using frozen foods in the winter came from various summer status categories as follows:

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[2] Prepared by Evelyn Grossman.

[3] Summer: Sept. 8–Oct. 10; Winter: Jan. 13–Feb. 13.

[4] Summer: July 13–Aug. 11; Winter: Jan. 11–Feb. 6.

	Baltimore *Number*	Indianapolis *Number*
Using frozen food in winter	273	290
Summer status:		
Not contacted [1]	28	20
Not housekeeping	10	11
Housekeeping—not participating.	(1)	3
Scheduled:		
Using frozen foods	179	172
Not using frozen foods	34	20
Different households	22	64

[1] Housekeeping not participating included with those not contacted in Baltimore.

Evaluation of Sample

Some information was asked of all the housing units and households visited, whether or not they were eligible or willing to participate in the survey. Their characteristics, when compared with the reports by the Bureau of the Census for the city as a whole, provide some basis for evaluating the sample of all households. Table 12 contains some appropriate data, with footnotes indicating the various population groups described.

A comparison of the eligible and ineligible households can provide a framework for placing the scheduled households in the context of all households in the city. A further comparison of the characteristics of the scheduled households with those not willing or able to participate, although they were eligible to be interviewed (housekeeping), provides a basis for evaluating bias of nonresponse. Table 13 shows the characteristics of the various groups of households surveyed each season in the two cities.

Seasonal comparisons provide an indication of the stability of population characteristics. Some of the comparisons are somewhat clouded because "scheduled" most often refers to those households in which frozen foods were used and because the eligible nonparticipants were not differentiated from those not contacted personally.

In Baltimore the census and each of the seasonal surveys show about the same vacancy rate, owner occupancy rate, household size, and proportion of households that are nonwhite. There is overrepresentation in the survey of husband-wife households and perhaps some overrepresentation of households in structures with five or more housing units at the expense of those in two-unit structures. For the other items, the population groups being compared do not match very well. Homemakers surveyed in the summer were less likely to be employed than were women 14 years of age and over in the city as a whole. In the winter, survey and census were alike. The homemakers surveyed had somewhat more formal education than did all women of 25 years of age or older in the city.

TABLE 12.—*Specified characteristics of households in Baltimore and Indianapolis, census and survey*

Characteristics	Baltimore			Indianapolis		
	Census 1960	Survey		Census 1960	Survey	
		Summer 1959	Winter 1960		Summer 1960	Winter 1961
Vacancy rate ... percent	5	4	4	6	6	5
Households by type of housing unit ... do	100	100	100	100	100	100
1-detached ... do	13	71	72	58	68	67
1-attached ... do	58			15	21	21
2 ... do	12	7	9	7	3	4
3 or 4 ... do	9	8	9	6	1	1
5 or more ... do	8	14	10	14	7	7
Owner-occupied housing units ... do	54	55	55	55	60	60
Lived in house ... do	100	[1]100	[1] 100	100	[1]100	[1]100
1 year or less ... do	19	18	15	25	25	27
2 or 3 years ... do	17	19	19	18	12	17
4–6 years ... do	17	17	18	16	14	16
7 or more years ... do	47	46	48	41	49	40
Persons per occupied household ... number	3. 3	3. 5	3. 5	3. 1	3. 1	3. 2
Husband-wife households ... percent	61	74	71	68	69	68
Nonwhite households ... do	29	[1]30	32	18	28	30
Family income (median) ... dollars	5, 660	[1]4, 530	[1]4, 300	6, 110	[1]5, 410	[1]4, 790
Employed women ... percent	[2]37	[3] 31	[3]36	[2]40	[3]37	[3] 36
Years of schooling of homemaker ... do	[4]100	[1,3]100	[1,3]100	[4]100	[1,3]100	[1,3]100
0–8 years ... do	50	34	36	35	33	30
9–11 years ... do	21	28	24	23	23	21
12 years ... do	20	27	25	27	32	39
More than 12 years ... do	9	11	15	15	12	10

[1] Based on households using frozen food.

[2] Based on women aged 14 years or more.

[3] Based on female homemakers.

[4] Based on females aged 25 years or more.

Survey households using frozen food lived in their homes about the same length of time as did all households in the city. This might be expected because use of frozen food is probably not related to stability in housing. Income comparison, however, is less informative; the survey families are only those using frozen food and they might be expected to have higher incomes than all families. On the other hand, census families exclude single individuals who were included in the survey if they were housekeeping. One-person families tend to have lower incomes than larger families. The lower incomes among the surveyed families may imply an underestimate of the use of frozen food in the survey, but may merely indicate lack of comparability in the population groups.

Similar comparisons in Indianapolis show that the census and survey reports are essentially the same for the vacancy rate, length of time the household lived in the housing unit, household size, proportion of households with husband and wife, and proportion of homemakers who are employed. There is considerable overrepresentation of nonwhite households in the survey, of households in single-unit structures, and slight overrepresentation of owner-occupied housing units. High-income families are underrepresented, but the homemakers have slightly more formal education than the city's women 25 years of age or older.

In both cities the households that were not contacted and those that were nonhousekeeping had certain characteristics in common—on the average, they had fewer household members (1.9–2.7) than all those scheduled (3.3–3.8); a smaller proportion of husband-wife households (46–69 percent versus 71–77 percent); a larger proportion of households with no female head (4–17 percent versus 1–3 percent); and a larger proportion of the female homemakers employed (30–92 percent versus 27–34 percent). In Baltimore there were proportionately more nonwhite families among the nonhousekeeping households than among those scheduled, but in Indianapolis the proportions were about the same. Owner-occupancy rate and type of housing unit occupied showed no particular pattern. In spite of the differences which reflect both the influence of ineligibles and bias of nonresponse, the nonscheduled households were not numerous enough to influence materially the measures of these characteristics.

A comparison of characteristics of the households in the two seasons indicates that when groups were sufficiently large for comparison, there were no important seasonal differences in Indianapolis other than lower income in the winter. In Baltimore, the winter survey showed more of the female homemakers employed, as well as lower income.

It may be assumed that the scheduled households represent the housekeeping households visited in the two cities, but that those visited overrepresent the husband-wife households in Baltimore, and the nonwhite households and those in single-unit structures in Indianapolis. In both cities, higher income families may be underrepresented. Although other studies have shown that frozen-food use tends to increase with income, little is known about the relationship of the other characteristics to its use. The biases form no definite pattern and are therefore not likely to have any particular effect on the frozen-food data.

TABLE 13.—*Characteristics of households by survey status in Baltimore (summer 1959 and winter 1960) and Indianapolis (summer 1960 and winter 1961)*

Characteristic	All households		Not contacted		Not housekeeping		Scheduled					
	Summer	Winter	Summer	Winter	Summer	Winter	All		Using frozen food		Not using frozen food	
							Summer	Winter	Summer	Winter	Summer	Winter
	Baltimore											
Number	377	377	57	57	17	13	303	307	242	273	61	34
Nonwhite [1] percent	NA	NA	NA	NA	NA	46	NA	32	30	33	NA	NA
Owner-occupied housing units do	55	55	62	71	47	54	55	52	55	52	54	56
Persons in household do	100	100	100	100	100	100	100	100	100	100	100	100
1 do	10	12	22	20	24	46	8	9	6	10	15	3
2 do	28	26	38	40	46	23	24	24	25	23	19	29
3 do	20	19	22	14	12	8	20	20	19	20	26	24
4 do	18	17	7	14	12	23	20	17	20	17	20	15
5 or more do	24	26	11	12	6	0	28	30	30	30	20	29
Mean number	3. 5	3. 5	2. 5	2. 6	2. 5	2. 1	3. 7	3. 8	3. 8	3. 7	3. 4	3. 6
Husband-wife households percent	74	71	69	68	47	46	77	72	81	71	61	82
No female head do	2	3	4	6	12	8	1	3	1	3	2	3
Female homemakers employed do	31	36	49	30	53	92	27	34	27	35	27	27
Households by type of housing unit do	100	100	100	100	100	100	100	100	100	100	100	100
1-detached 1-attached do	71	72	71	75	64	61	71	72	68	71	85	82
2 do	7	9	7	8	6	8	7	9	8	9	3	6
3 or 4 do	8	9	9	8	12	23	8	9	9	9	2	12
5 or more do	14	10	13	9	18	8	14	10	15	11	10	0

	Indianapolis											
Number	397	400	63	78	25	12	309	310	265	290	44	20
Nonwhite [1] percent	NA	NA	NA	NA	24	33	28	30	24	29	54	42
Owner-occupied housing unit do	60	60	60	73	60	42	62	58	64	60	46	35
Persons in household do	100	100	100	100	100	100	100	100	100	100	100	100
1 do	13	15	19	29	16	25	12	12	11	11	16	25
2 do	35	32	39	42	48	58	32	27	30	27	45	40
3 do	16	16	12	12	20	17	17	17	18	18	9	0
4 do	18	17	21	12	4	0	18	19	19	20	14	5
5 or more do	18	20	9	5	12	0	21	25	22	24	16	30
Mean number	3. 1	3. 2	2. 7	2. 3	2. 6	1. 9	3. 3	3. 5	3. 3	3. 5	3. 0	3. 4
Husband-wife households percent	69	68	63	61	52	58	73	71	75	73	59	35
No female head do	5	4	8	7	16	17	3	3	2	2	11	15
Female homemakers employed do	37	36	64	45	40	50	33	33	33	33	28	24
Households by type of housing unit do	100	100	100	100	100	100	100	100	100	100	100	100
1-detached do	68	66	60	74	64	42	69	66	72	67	55	55
1-attached do	21	21	24	15	20	16	21	22	20	22	25	30
2 do	3	4	2	3	0	0	4	4	4	4	2	5
3 or 4 do	1	2	0	0	4	0	1	2	0	2	7	0
5 or more do	7	7	16	8	12	42	5	6	4	5	11	10

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[1] NA means this question was not asked of the specified households.

APPENDIX B

Household Refrigerating Units: Ownership and Age

TABLE 14.—*Ownership and median age of refrigerating units*

City and season	Units	Owned [1]	Median age [2]
	Refrigerators and refrigerator-freezers		
	Number	*Percent*	*Years*
Baltimore:			
Summer	222	86. 0	6
Winter	247	86. 2	6
Indianapolis:			
Summer	228	96. 1	6
Winter	246	94. 7	6
	Separate freezers		
Baltimore:			
Summer	14	100	4
Winter	14	100	4
Indianapolis:			
Summer	33	100	4
Winter	28	100	6

[1] Equipment purchased when new and when used.

[2] Equipment owned by the household and purchased when new.

TABLE 15.—*Distribution of refrigerating units according to age* [1]

City and season	Units	5 years or less	6 to 10 years	11 to 15 years	16 years and more
	Refrigerators and refrigerator-freezers				
	Number	*Percent*	*Percent*	*Percent*	*Percent*
Baltimore:					
Summer	167	35. 9	37. 7	20. 4	6. 0
Winter	171	39. 2	34. 5	21. 6	4. 7
Indianapolis:					
Summer	169	36. 1	32. 5	25. 4	5. 9
Winter	171	40. 4	34. 5	21. 1	4. 1
	Separate freezers				
Baltimore:					
Summer	13	53. 8	38. 4	7. 7	0
Winter	13	53. 8	46. 2	0	0
Indianapolis:					
Summer	25	52. 0	36. 0	12. 0	0
Winter	27	37. 0	51. 9	3. 7	7. 4

[1] Equipment owned by the household and purchased when new.

APPENDIX C

Frozen-Food Use and Purchase as Related to Use and Purchase During Survey Week

TABLE 16.—FROZEN-FOOD USE: *Distribution of households by last previous use of specified food as related to use in survey week*

City and season	Households in sample	Not using in survey week			Using in survey week					
		And never using any	But last previous use		All [1]	And last previous use				
			More than 1 month before	During month before		1 week before	2 weeks before	3 weeks before	1 month before	More than 1 month before
	Fruits									
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Baltimore:										
Summer	303	53.8	24.5	13.1	8.6	5.9	0.7	1.0	0.3	0.7
Winter	307	45.6	32.3	11.7	10.4	3.9	1.6	1.6	1.6	1.3
Indianapolis:										
Summer	309	36.9	35.9	15.2	12.0	3.9	1.0	.6	2.3	3.5
Winter	310	34.2	42.2	13.9	9.7	2.6	1.9	1.3	1.6	2.2
	Juices									
Baltimore:										
Summer	303	34.7	16.4	14.0	34.9	27.1	4.0	1.0	1.7	0.9
Winter	307	30.0	20.2	11.7	38.1	29.0	3.6	2.3	.7	1.3
Indianapolis:										
Summer	309	30.7	17.1	14.0	38.2	25.9	7.1	.6	1.9	2.6
Winter	310	25.5	29.0	17.1	28.4	21.9	3.2	1.3	1.3	.9

	Vegetables									
Baltimore:										
Summer	303	23. 4	11. 5	15. 9	49. 2	33. 3	7. 9	2. 0	1. 3	4. 5
Winter	307	16. 0	12. 4	13. 0	58. 6	37. 5	8. 8	5. 5	2. 0	3. 0
Indianapolis:										
Summer	309	22. 3	18. 4	20. 1	39. 2	21. 4	7. 1	4. 9	1. 9	3. 8
Winter	310	13. 5	25. 1	18. 1	43. 2	29. 4	11. 0	1. 0	. 6	1. 2
	Meat, poultry, fish									
Indianapolis:										
Summer	309	28. 8	21. 3	21. 7	28. 2	11. 7	6. 5	1. 6	4. 5	3. 9
Winter	310	20. 0	23. 9	25. 1	31. 0	12. 9	5. 8	3. 5	3. 5	4. 7
	Baked goods									
Indianapolis:										
Summer	309	55. 3	19. 4	16. 2	9. 1	2. 3	2. 9	0. 6	1. 3	1. 5
Winter	310	51. 0	21. 2	16. 9	11. 0	4. 8	1. 9	. 6	1. 2	1. 8

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[1] Sum of components may not equal total because of rounding or because frozen food had been used in survey week but not before.

Table 17.—Frozen-food purchase: *Distribution of households by last previous purchase of specified food as related to purchase in survey week*

City and season	Households in sample	Not buying in survey week			Buying in survey week					
		And never buying any	But last previous buying		All [1]	And last previous buying				
			More than 1 month before	During month before		1 week before	2 weeks before	3 weeks before	1 month before	More than 1 month before
					Fruits					
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Baltimore:										
Summer	303	54.8	22.0	16.0	7.3	4.6	0.7	0.7	0.3	1.0
Winter	307	45.9	32.2	11.8	10.1	3.3	1.3	1.6	1.3	2.0
Indianapolis:										
Summer	309	37.2	37.3	15.1	10.4	3.6	1.0	.3	2.6	2.7
Winter	310	34.5	45.2	10.6	9.7	2.6	1.6	1.3	1.9	2.1
					Juices					
Baltimore:										
Summer	303	34.7	16.2	20.1	29.0	20.1	4.3	2.0	1.0	0.9
Winter	307	30.0	20.8	15.7	33.6	24.1	4.6	1.3	1.0	1.3
Indianapolis:										
Summer	309	30.7	20.0	17.2	32.0	21.4	6.1	.6	1.9	1.9
Winter	310	25.5	31.3	21.0	22.3	15.5	2.9	1.0	1.3	1.5
					Vegetables					
Baltimore:										
Summer	303	23.4	11.9	23.1	41.6	26.7	7.9	1.7	2.3	2.6
Winter	307	16.0	13.7	17.9	52.4	30.9	8.1	4.9	2.9	3.6
Indianapolis:										
Summer	309	22.3	21.9	19.8	35.9	17.8	7.4	5.2	1.9	3.5
Winter	310	13.5	27.8	20.3	38.4	21.0	10.6	3.2	1.9	1.5

	Meat, poultry, fish									
Indianapolis:										
Summer	309	28. 8	22. 8	20. 9	27. 5	11. 0	7. 4	0. 6	4. 2	4. 2
Winter	310	20. 0	24. 8	25. 5	29. 7	11. 3	5. 5	2. 9	4. 2	5. 4
	Baked goods									
Indianapolis:										
Summer	309	55. 7	19. 9	16. 0	8. 4	2. 3	2. 9	0. 3	1. 3	1. 5
Winter	310	51. 0	21. 9	15. 5	11. 6	4. 2	1. 9	1. 3	1. 3	2. 2

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[1] Sum of components may not equal total because of rounding or because frozen food had been purchased in survey week but not before.

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